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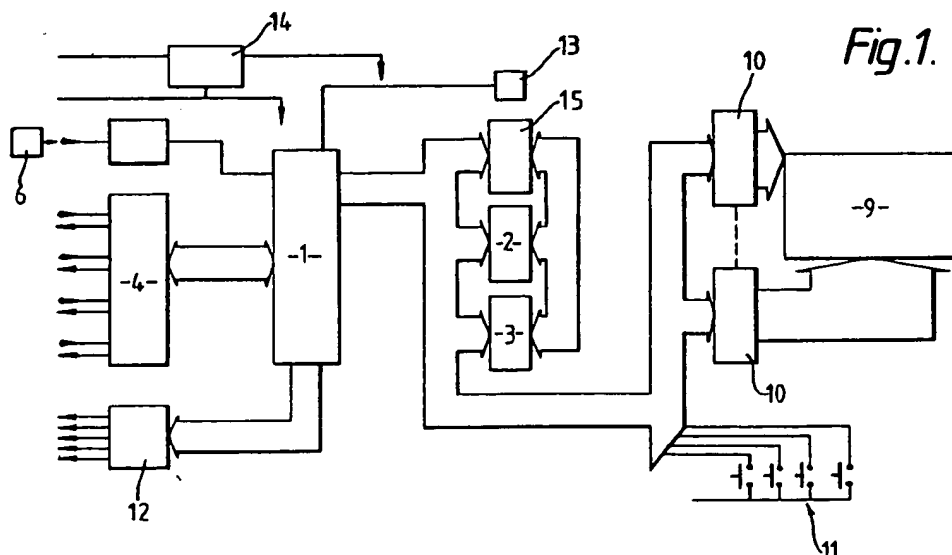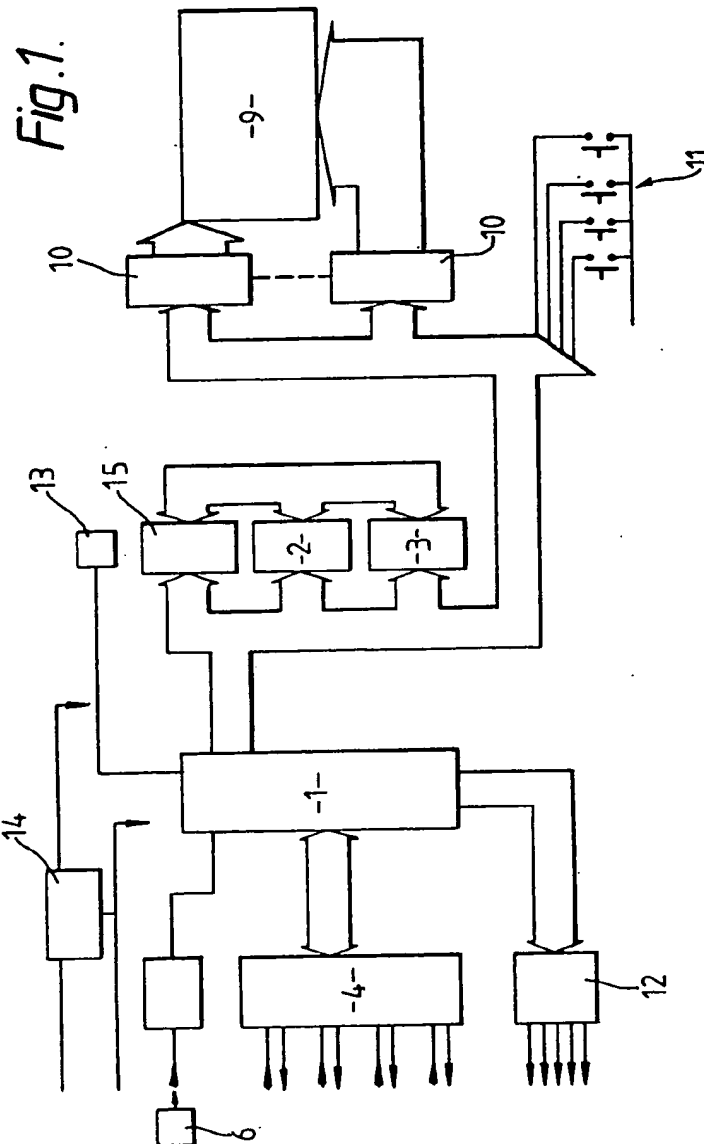GB 1586557
GB 1571085

(58) Field of search
G4T
G1K

(54) **Taxi meters**

(57) A transport data processor suitable for use as a taxi meter comprises a micro processor 1 connected to a programmable read only memory 2 and a non-volatile random access memory 3. An input/output control 4 provides interfacing between peripherals, such as a data radio or a printer, and the micro processor. A display panel 9 displays information routed by the micro processor. Such information can comprise charges and/or dispatch messages received through the input/output control 4. To allow for time dependence of changes in tariff values a clock 13 is connected to the micro processor 1.

In this way an intergrated transport data processor is provided capable of communication between a base and a mobile unit in addition to linking a metering device, credit card or similar reader printer with the base through a radio link.
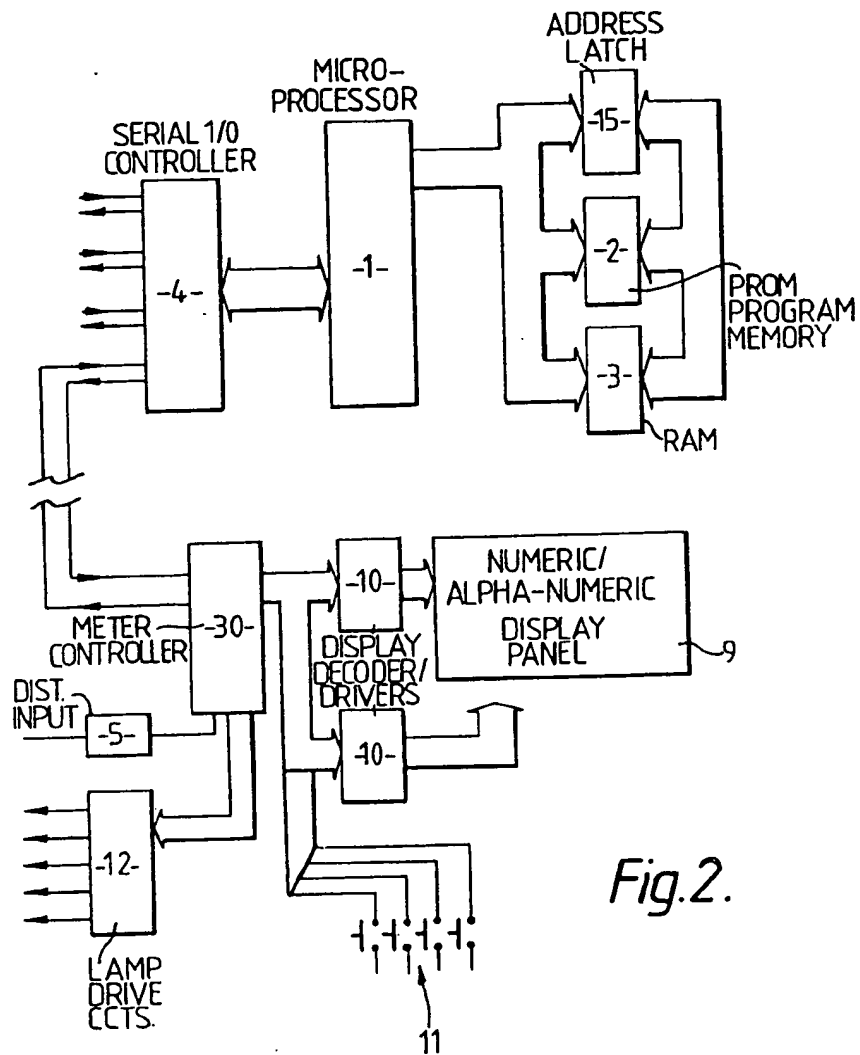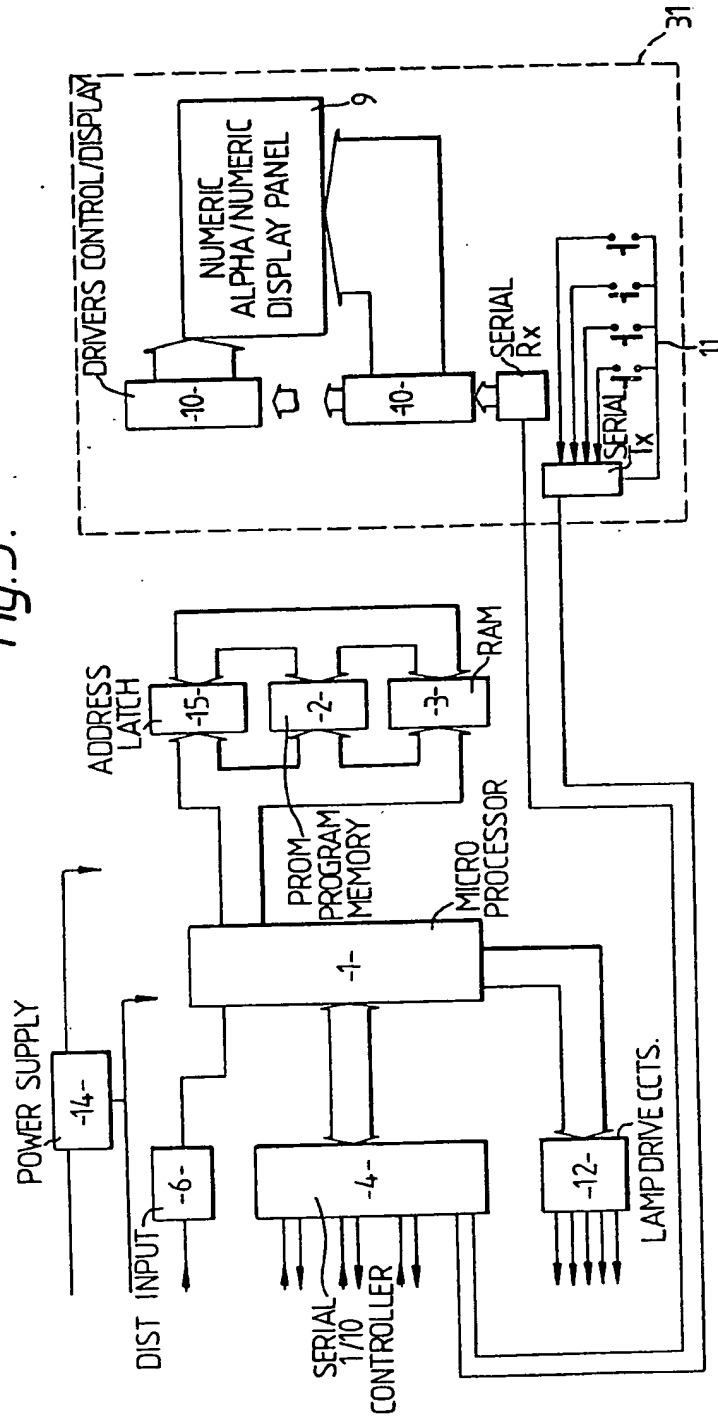
Fig.1.

GB 2 143 981 A

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Fig.1.

Fig.2.

Fig.3.

RADIO TELEPHONE 16

"SPARE"

AUX DISPLAY

CREDIT CARD READER 23

PRINTER 25

SERIAL DATA CONTROLLER 4

MAIN PROCESSOR 1

10

DISPLAY CONTROLLER

STATUS LAMP DRIVE CIRCUITS 12

METERING DISTANCE +TIME

ALPHA-NUMERIC DISPLAY PANEL 9

VEHICLE BATTERY 14

DIST TRANSDUCER 6

Fig. 4.

Fig. 8.

DIGITAL PULSE

8 SCHMIDT TRIGGER

AMPLIFIED ELECTRIC SIGNAL

37 AMPLIFIER

ROTATING MAGNET FIELD
N   S

6 HALL-EFFECT SENSOR

5

7

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A15   7

Vacant

MODE   ZONE   QUEUE   VOICE

Fig.5.   11a   11b   11c   11d

**MR. MATHERSON
15 RIVERSIDE DR.**

Vacant

MODE   REJECT   ACCEPT   VOICE

Fig.6.   11a   11b   11c   11d

$1·20/Km   HIRED

3·1 | 0·50 | 12·65

RATE | EXTRAS | FARE | RECEIPT

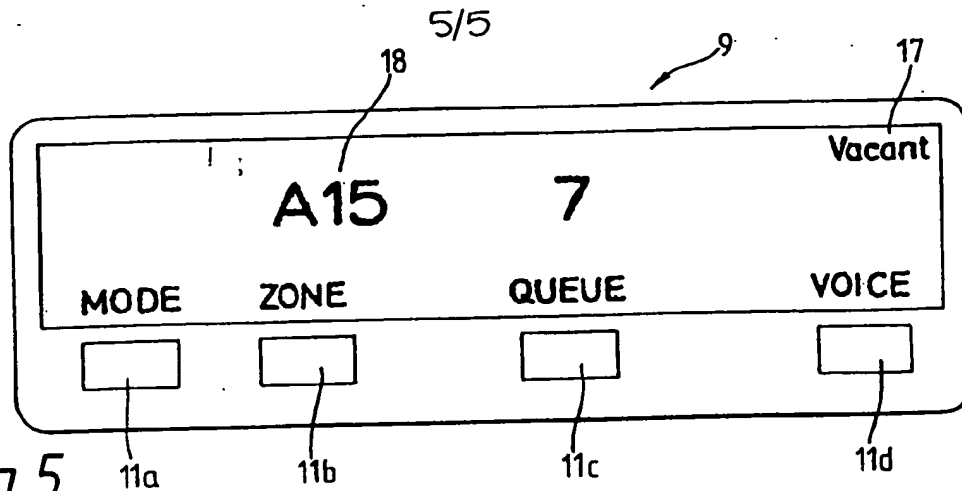Fig.7   11a   11b   11c   11d

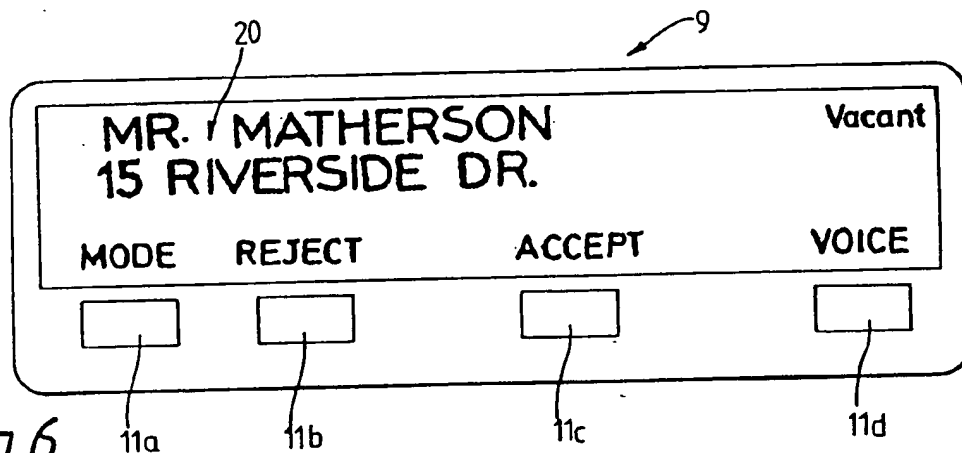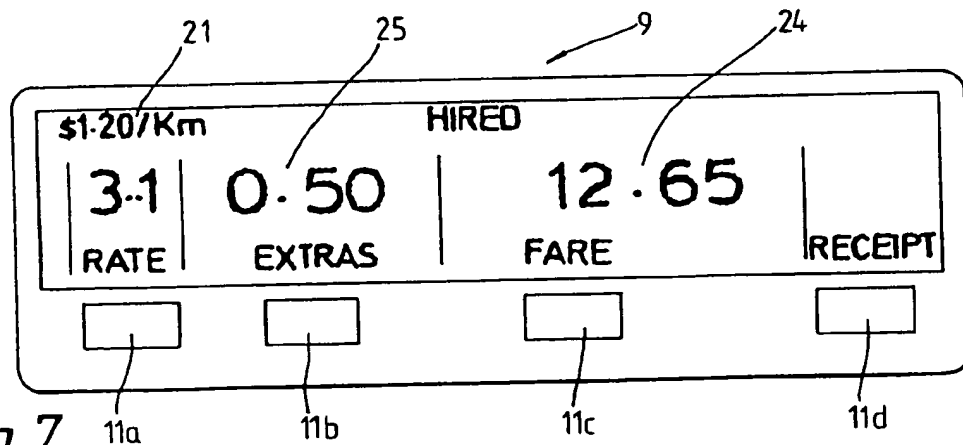## SPECIFICATION

Improvements in or relating to taxi meters ·

5 This invention relates to transport data processes.

In the passenger transport industry there is a growing need for increased efficiency flexibility and versatility whether the vehicle be a
10 taxi a mini bus or a bus. Passengers demand faster response times and cheaper fares.

It is an object of the present invention to provide a transport data process which will go at least some distance towards meeting the
15 foregoing desiderata or which will at least provide the public with a useful choice.

Accordingly the invention consists in a transport data processor comprising processing means, non volatile storage means, data com-
20 munication means and display means, said processing means being arranged to process and control the transfer of data, including fixed and running data, between said data communication, said storage means and said
25 display means, including the calculation of charges and the direction of required data to said data communication means and/or said display means as appropriate.

In the preferred form of the invention a
30 transport data processor or metering device is provided which includes a processing means, interfacing means, a non-volatile storage means and a display means. The processing means processes or controls data passing to
35 and from peripheral units including units such as a printer, credit card reader, data radio, base computer, storage means and the display means all of which are wellknown in themselves. The processing means also performs
40 all the calculations involving transactions and fare metering. The storage means provides retention of both fixed and running data. Fixed data refers to information which is altered relatively infrequently such as fare sche-
45 duling data and the like and which can be organised for optimum flexibility. Running data refers to data relating to the operation of the vehicle such as the distance travelled and other data which is based on a particular trip.
50 The display means includes a fare readout, a readout suitable for displaying messages such as may be held in the data storage means or which may be received from other peripheral units such as dispatch information, or district
55 status information, credit card type, meter status or tariff.

The interfacing means preferably are provided in the form of a plurality of serial communication ports through which operating
60 instructions, data and/or messages can be passed and directed to the required peripheral or to the processing means. The routing of such information is preferably controlled by the processing means. The preferred form of
65 the inventi n will be described by reference to

a taxi meter communicating directly with peripheral units but the invention is useable as a v hicle mounted processing means in a separate housing controlling peripherals as de-
70 scribed above plus a control/display panel for driver of the operation and display of the taxi fare. The invention can be modularized in one of a number ways, including constructions in which the peripherals are contained within a
75 single housing unit with the central unit or attached to that central unit.

Where the system is to be used in a mass transport system such as a bus or parcel system, it may be impractical or undesirable
80 to display charges as they accrue. In such circumstances by passing a charged card or a prepaid card through a card reader peripheral at the beginning of the trip and again upon alighting i.e. at the end of the trip the indivi-
85 dual transaction can be recorded and payment either automatically debited or charged. Tickets and receipts can likewise be automatically issued.

In computing a fare to be charged a tran-
90 sport data process for example a taxi meter uses as a basis distance travelled and waiting time incurred. Waiting time is normally charged only when the speed of the vehicle is less than a predetermined limit. The distance
95 information is provided through the speedometer drive system sensed by a suitable transducer or in the case of electronic speedometers the distance information can be determined directly from the vehicle wiring. The
100 meter uses the distance and timing circuits to compute the fare in accordance with the fare structure in force for that particular hiring. This structure can be held in the fixed data memory or in the event of special fare struc-
105 tures can be communicated through a radio link from a base computer to the taxi meter. Under normal circumstances however the particular fare structure will be read from the fixed data memory and used to compute the
110 fare. The selection of the fare structure, that is the tariff number, could be selected manually, or automatically in accordance for example with the time of day, nature of the fare, district or zone. This selection and/or the
115 application of additional charges can be made from a base station through a radio link. Likewise where the tariff is required to change during a trip due to entering a new zone or entering a time of day for which different
120 tariffs are applicable the selection can be made automatically. Furthermore the tariff structure can be enhanced to accommodate a plurality of passengers where individual passengers can share a taxi and travel at rates
125 cheaper than individual rates. This can be implemented by dividing each tariff rate into a number of subrates, each subrate being related to th numb r of passengers sharing the taxi at that particular time. Thus with the
130 combination of fixed data memory and data

communication to a base computer control or
variation of th fare structur and th simpli-
city of operation are great.

One preferred form of the invention will
5 now be described with reference to the ac-
companying drawings in which, Fig. 1 is a
block schematic diagram of one preferred
form of transport data processor according to
the invention,
10 *Figure 1* is a block schematic diagram of
one preferred form of transport data processor
according to the invention,

Figure 2 is a block diagram as in Fig. 1
including a second micro processor to perform
15 some of the functions of the meter,

Figure 3 is a block diagram as in Figs. 1
and 2 wherein the display and control panel
constitutes a remote unit,

Figure 4 is a schematic diagram of mobile
20 equipment including a taxi meter and its per-
ipherals.

Figures 5, 6 and 7 show a display panel for
for use with the transport data processor of
the invention in different modes of operation,
25 and

Figure 8 is a block diagram representing a
Hall Effect sensor for use in one form of the
invention.

Figure 8 is a block diagram representing a
30 Hall Effect sensor for use in one form of the
invention.

Referring to Fig. 1 a taxi meter is shown
comprising a micro processor 1, a program-
mable read only memory (PROM) 2, a random
35 access memory (RAM) 3 and a connection
means, such as an an input output control
(IOC) 4. The micro processor 1 carries out the
required computations of the taxi meter under
the control of the programme contained in the
40 PROM 2. RAM 3 is a non-volatile memory
storing both fixed data and running data. This
memory can be in the form of an electrically
alterable read only memory, a battery back
CMOS memory or other equivalent device.
45 The IOC 4 provides interfacing between per-
ipherals such as above set forth and in parti-
cular provides an input/outport port for
example a serial port through which the fare
schedule can be passed or controlled for
50 example, through a radio data link which may
utilise an existing radio telephone link to a
base computer.

Distance information is obtained from the
speedometer cable 5 by means of a HALL
55 effect sensor 6 which detects the rotating
magnetic field of a small magnetic collar 7
attached to the cable 5. The Hall Effect sensor
preferably passes a signal to an amplifier 37 ,
and then to a schmidt trigger 8 so as to
60 provide the required digital pulse to the micro
processor 1.

The fare to be paid is displayed on a display
panel 9 which in its simplest form can be a
row of seven segment digital displays but in
65 the preferred form of the invention where it is

desired also to display messages on the dis-
play panel 9 a dot matrix panel is preferred.
This can take the form of an LCD pan l or an
LED alpha numeric display with suitable deco-
70 der driver chips 10.

In addition to displaying fare this panel 9
can display accumulated trip related data as
well as messages to identify the display para-
meter, meter mode or status tariff and switch
75 labels and information can also be displayed
relating to the fare or fares and passenger or
passengers.

Taxi dispatch information and zone queuing
information can be displayed on the panel 9
80 also.

Operation may be effected by four push
button switches 11 by reference to Fig. 1
being labelled 11a 11b 11c 11d in Figs. 5 to
7. The function of the switches 11a to 11d is
85 dependent upon the mode of the meter that is
to say when hired the switches may be as-
signed the functions each of the switch "rate"
"extras" "fare" and "receipt" for example.
When vacant the operation may relate to job
90 dispatching and the switches may be assigned
the functions "mode" "accept" "reject" "to-
tals" and in a search mode the switches may
be assigned the functions "mode" "queue"
"zone" and "schedule."
95 A capacity is provided to drive indicator
lamp circuit 12 external to the meter and
depending upon the local requirements these
can include "engaged," "for hire,"
"stopped," "tariff," "number of passen-
100 gers," "penal rates" and "courtesy light" for
example.

To allow for automatic tarrif changes at
night and on holidays and also to provide
dated receipts a real time device such as clock
105 13 which is controlled by the micro processor
1 and is powered desirably by auxiliary bat-
tery. Other functional blocks shown on the
schematic diagram of Fig. 1 include a power
supply 14 and an address latch 15 as may be
110 required.

Inputs to the IOC 4 can include for
example, engine data, such as engine speed,
fuel useage, temperature and fault para-
meters. The software can process this to pro-
115 vide information on vehicle operating condi-
tions and performance.

As the regulations pertaining to taxi meters
differ from country to country and because
the particular function of the system depends
120 largely on its software rather than the hard-
ware hereinbefore described the software is
written preferably in a high level language so
as to be easily changed to meet any require-
ments and in the next part of th description
125 on arbitrary taxi trip will be describ d in order
to explain the operation of the mobile system.

With the taxi initially vacant and the driver
seeking a fare or passengers the driver is able
to interrogate the taxi qu ues in his area
130 through the control panel as shown at Fig. 5

to seek data relating to the various zon s or ranks which ar able to be displayed on his panel through the radio link 16 in Fig. 2 which links with the base computer.

5   With the meter initially showing vacant at 17 and the zone selected at 18 by operation of button 11b the base computer knows that that particular taxi is available and also which zone the taxi is in.

10   When a job passenger or fare is allocated to this taxi the address is displayed as shown at 20 in Fig. 6 and the driver can accept or reject the job by pushing the appropriate button 11b or 11c indicated in Fig. 6. Assum-

15   ing that the driver accepts the job and drives to the address required. When the passenger enters the car the mode button 11a is pressed to select the metering mode and the fare is started on the appropriate tarrif see Fig. 7

20   which is indicated at 21. The tariff can be set manually or automatically using information within the meter that is to say stored in the RAM 3 or can be set automatically using information received from the base computer

25   through the radio link 16.

In certain places discount fares are available to special categories of passengers for example the elderly and the handicapped. In these circumstances the appropriately magnet-

30   ically coded card provided by the passenger is entered into the card reader 23 and the transaction adjusted and recorded accordingly. The card reader 23 can be caused to accept standard credit cards and also credit cards

35   appropriate to that taxi operation also. On line validity checking is of course possible. If man- ual operation is required the fare is started by using the fare button 11c in Fig. 7 and the fare is displayed as it accrues at 24 and extras

40   can be incremented by the use of button 11b so that the extras are shown at 25 in the manner presently known. At the end of the trip the fare to be paid can be either charged to an account using a card in the credit card

45   reader 23 or paid by cash. A receipt can be issued from the receipt printer 25 and can include for example data time trip reference number fare paid and the like. Upon clearing the fare from the meter another job can be

50   requested or issues on the queue situation can be interrogated again as above described.

For efficient management of taxi fleets drivers can use specially coded magnetic cards to sign on and off thus the base knows

55   at all times how many and which taxis are operating and who the driver is. Metering can be disabled and this is done if required for example this can be achieved by inhibiting the operation of the meter until the driver using a

60   magnetic card in the card read r 23 signs on. An acknowledgement from the base to the radio link 16 signals the beginning of the driver's shift and the meter is accordingly enabled and enters the for hire mode auto-

65   matically. The driver can sign off in a similar

mann r and th signing off can be us d to initiate a printout of running totals for that shift. These totals can be transmitted to the base and it would be possible to use this

70   information to for example calculate the driver's wages.

If desired a prepaid card system can be used whereby the fare is automatically dis- counted from a passenger's credit by the base

75   computer through information relayed through the radio link 16.

A printout of the fare schedule on the display and/or the printer could be instigated by pressing an appropriate button 11a to

80   11d. This would read the fare schedule from the fixed memory 3 and display in it a suit- able form. Where the fare schedule required updating from time to time in accordance for example with local regulations the new fare

85   schedule data can be transmitted from the base station through the radio link 16 to for example taxis either individually or collectively in a suitably coded manner in order to update the data held in the fixed data memory 3. An

90   alternative method is to access the data passed through the rear connector or a serial port with a programming unit. In addition to shift totals non-erasable continuous totals can be logged and displayed or printed.

95   Data from the taxi base by use of the base computer and the radio link 16 can be used to control the taxi meter to for example start and stop the fare, change the tarrif, increment extra charges, implement special rates, re-

100   quest operating data, cancel a fare, disable and enable the meter operation, discount the taxi fare, acknowledge valid credit cards, ac- cess running totals or other data held in the meter, update the fare schedule data, and

105   alter or synchronise the time of day clock 13.

In the construction shown in Fig. 2 the main processor 1 is freed from the tasks of metering by the provision of a second micro computer or processor 30 which is in the

110   form of a dedicated controller linked to the main processor 1 through the input/output controller 4.

In the construction shown in Fig. 3 the display and control panel 9 is provided in a

115   remote unit 31 connected to the meter through the serial input and output controller of 4.

Fig. 4 shows in particular how the various peripheral units fit in with the meter.

120   Thus it can be seen that at least in the preferred form of the invention are integrated transport data processor is provided which is able to provide data communication between a base and mobile units carried on a vehicle

125   linking a metering device, cr dit card or simi- lar reader printer with th bas computer through a radio link. The result at least in the preferred form of the invention is an efficient computerised system which can be easily tai-

130   lored to meet the needs of any transport

industry. Thus a metering device is provided which can be readily programmed, pr ferably in a high level computer languag , to adapt easily to virtually any rapid transport system,
5 and to interface with peripherals to constitute a transport management system. The metering device also serves as a system interfacing unit, visual display panel and a fare calculating computer.
10
CLAIMS
1. A transport data processor comprising processing means, non volatile storage means, data communication means and dis-
15 play means, said processing means being arranged to process and control the transfer of data, including fixed and running data, between said data communication means, said storage means and said display means, in-
20 cluding the calculation of charges and the direction of required data to said data communication means and/or said display means as appropriate.
2. A transport data processor as claimed
25 in claim 1 wherein said transport data processor comprises a taxi meter.
3. A transport data processor as claimed in claim 1 or 2, wherein said data processing means processes and controls the transfer of
30 data further including text messages.
4. A transport data processor as claimed in any preceding claim wherein said data communication means includes connection means through which peripheral equipment is
35 connected to said processing means.
5. A transport data processor as claimed in claim 4 wherein said peripheral equipment includes one or more of a card reader, a data radio or a printer operation of said transport
40 data processor being capable of being controlled or affected by incoming data from said card reader and/or said data radio.
6. A transport data processor as claimed in any preceding claim wherein said display
45 means display data and messages including charges and despatch messages received through said communication means.
7. A transport data processor as claimed in any preceding claim contained in a housing
50 and having one or more articles of peripheral equipment contained in or attached to said housing.
8. A transport data processor as claimed in any preceding claim wherein said display
55 means comprise a dot matrix type display unit suitable for displaying fare and dispatch related date and text.
9. A transport data processor as claimed . in any preceding claim wherein said display
60 means is remotely positioned from said processing means being connected to said processing means through said communication means.
10. A transport data processor as claimed
65 in any preceding claim wh rein said display

means includes a control pan l having a plurality of switches there n said switches having varying functions depending on the mode of the operation of the meter.
70 11. A transport data processor as claimed in claim 10 wherein said control panel is positioned remotely from said processing unit.
12. A transport data procesor as claimed in any preceding claim wherein said com-
75 munication means is associated with a radio data link to enable said processing means to receive data to update the fare schedule held in said storage means.
13. A transport data processor as claimed
80 in any preceing claim wherein said data communication means receives engine data to enable said processing means to provide information on vehicle operating conditions and performance.
85 14. A transport data processor substantially as herein described with reference to the accompanying drawings.